Our First Aid Kit

St Augustine's CE High School


Our bandages
Our Water Purifiying Tablets
Our ice pack
Our First Aid Kit

Our First Aid Kit

- As many of us were originally involved in this project, we decided to do several smaller experiments so we could easily co-ordinate working together

- We chose “first aid kit” as our overall title for our smaller experiments

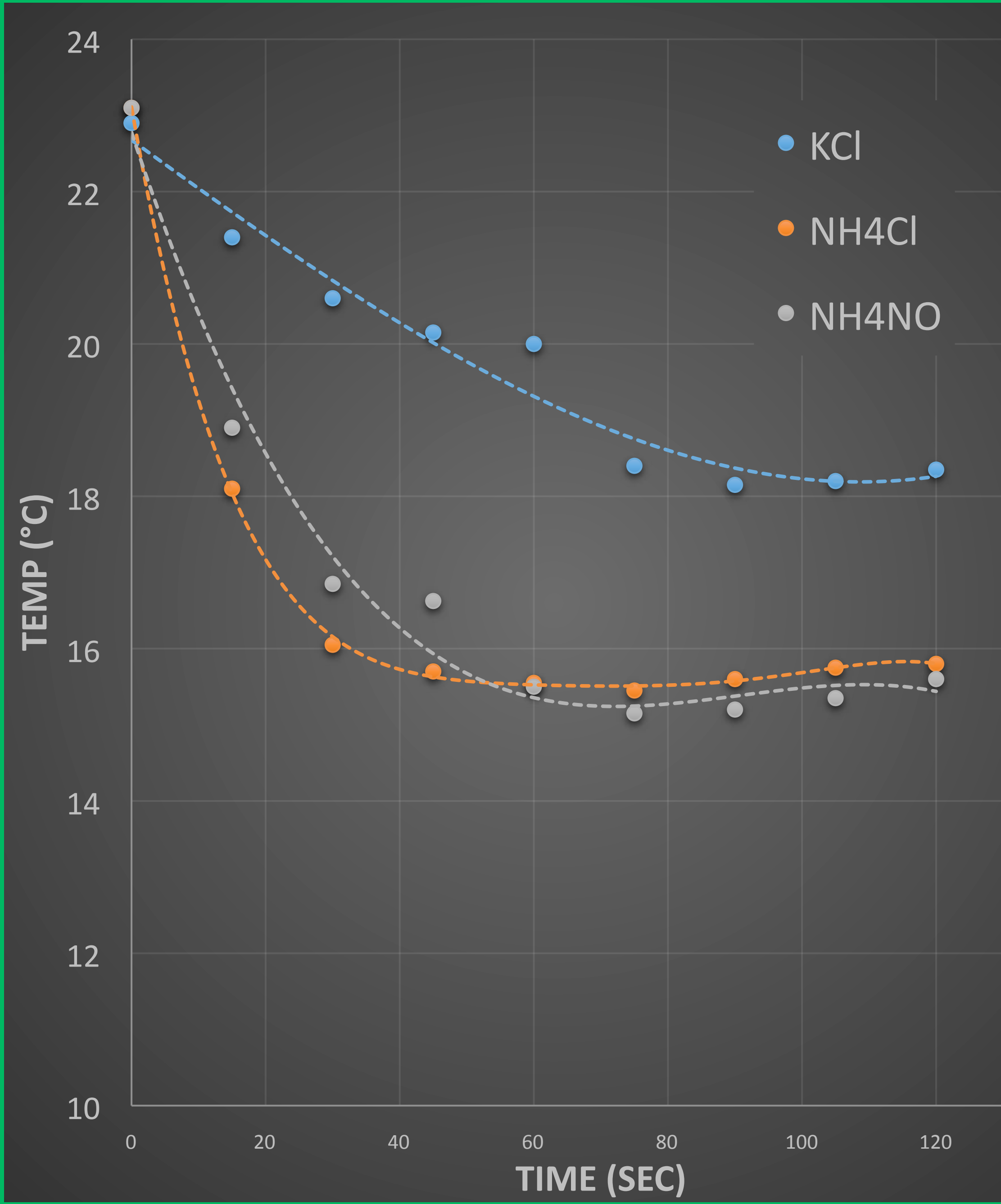
- We looked at Chemistry, Physics and Biology areas;
  - Testing the cooling effects of endothermic crystals for an **ice pack**
  - Testing the tensile properties and absorbency of **bandages**
  - Testing the effectiveness of **water purification tablets**

Ice Pack

- We are investigating which type of salt results in the biggest decrease of temperatu when reacted with water in an endothermic reaction. This data would be useful in choosing a salt for ice packs in first aid kits as ice packs are more effective for injurie when they are cooler.
- First of all, we weighed out 2g of potassium chloride using a balance and then poure it into a polystyrene cup of deionised water, stirring continuously at a steady pace.
- Then, we measured the temperature of the solution using a digital thermometer, recording the different temperatures at intervals of 15 seconds for 2 minutes.
- We repeated this to check the repeatability of our results and to calculate an averag for improved accuracy
- Finally, we repeated the investigation for ammonium chloride and ammonium nitra and plotted the results in a graph.

Ice Pack

- From our test results we have come to the conclusion that ammonium nitrate is the most effective salt to use to drop the temperature quickly.
- Further research also reveals that ammonium nitrate is the salt most commonly used in ice packs.
- However ammonium chloride is also another possible solution for ice packs. In the end we have decided that it would be most effective to use ammonium chloride.
- The temperature change is not as great however it is a safer salt than ammonium nitrate because it is safer to ingest and not explosive like ammonium nitrate is.



Time	Start Time	15 seconds	30 seconds	45 seconds	1 minute	1 min 15 sec	1 min 30 sec	1 min 45 sec	2 minutes	Temperature cha
T1	22.7	21.5	21.3	21.2	21.1	18.6	18.1	18.2	18.3	
T2	23.1	21.3	19.9	19.1	18.9	18.2	18.2	18.2	18.4	
T3	22.3	20.1	19.1	19.1	19	18.8	181	18.5	18.5	
Av	22.9	21.4	20.6	20.15	20	18.4	18.15	18.2	18.35	
CL T1	23.2	19.1	17.7	17.1	16.8	16.5	16.3	16.3	16.3	
CL T2	23	17.1	14.4	14.3	14.3	14.4	14.9	15.2	15.3	
CL T3	23.1	20.6	15.8	15.5	15.6	15.7	15.8	15.9	16.1	
CL Av	23.1	18.1	16.05	15.7	15.55	15.45	15.6	15.75	15.8	
NO3 T1	22.5	17.4	15.5	15.15	14.9	14.5	14.5	14.6	15.1	
NO3 T2	23.7	20.4	18.2	18.1	16.1	15.8	15.9	16.1	16.1	
NO3 T3	22.9	17.5	16.2	16.2	51.8	15.5	15.7	15.7	15.8	
NO3 Av	23.1	18.9	16.85	16.625	15.5	15.15	15.2	15.35	15.6	

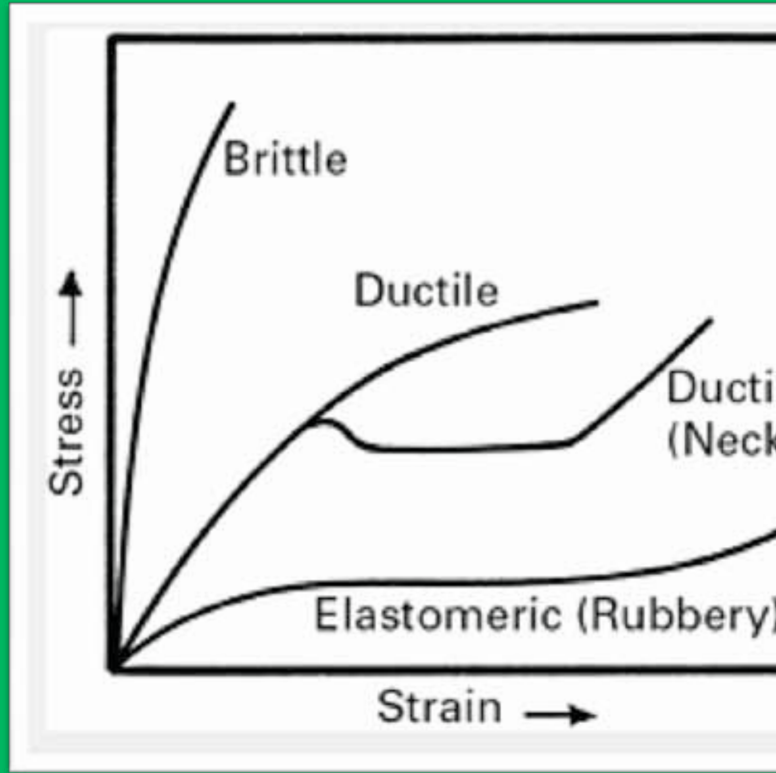
Bandages

fferent types of bandage will stretch different mounts due to different quantities of plasticisers and oss linking of polymer chains.

hen plasticisers increase the ability of a bandage to retch they will decrease its maximum load. In ontrast, when cross-links increase the maximum ad, they will decrease the ability to stretch. We will sume that the polymer being plasticised or cross-nked in each type is the same.

ur hypothesis is that the greater the maximum tension of the bandage, the less its maximum nsile load will be.

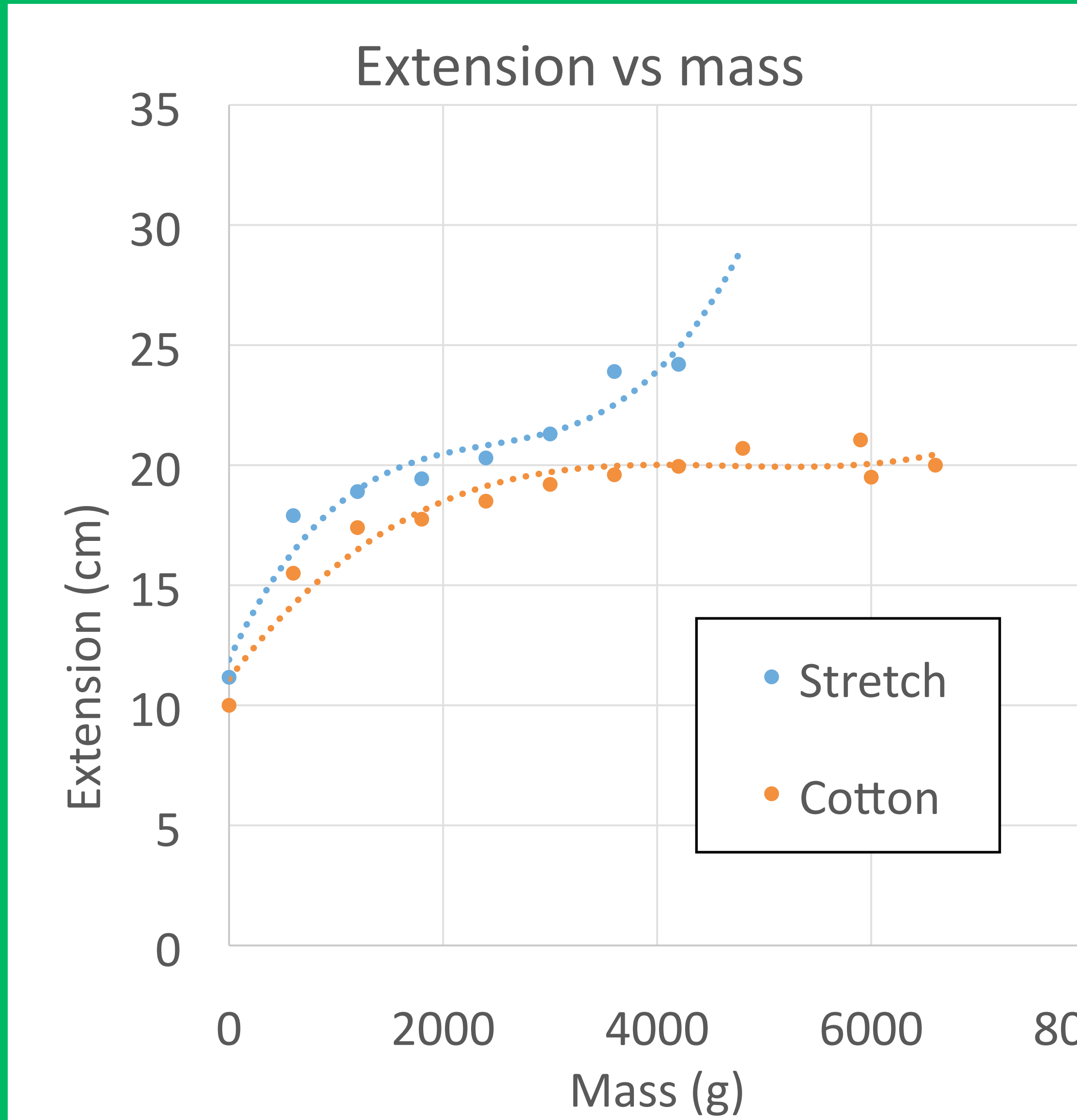
e compared two types of bandage, one described as stretch bandage, and another which was a simple otton bandage. The stretch bandage is expected to ow a curve like the “rubbery” one shown, and the otton bandage to show one of the ductile curves.



Bandages

We used equal width strips of the two types of bandage. We suspended them from a clamp attached to a clamp stand attached to the desk with a G-clamp.

We added slot-masses in ncrements and measured the extension each time, and also recorded the maximum load. We calculated averages from three repeats and plotted a graph.



Bandages

- Our graph shows the approximate shapes we expected from our research, supporting the reliability of results.
- We did find that the bandage that stretched most supported a lower maximum weight, so overall, our hypothesis was supported.
- We assumed that the thickness, quantity and type of individual polymer strands within the bandage were the same. If this assumption is incorrect, our results would not be valid.
- If we were to extend this experiment, we could use a micrometre screw gauge to find the diameter of individual strands and then find their cross-sectional area. Then we could calculate the stress on each bandage, and the stress from the extension versus initial length.
- This would allow us to compare materials instead of individual bandages

Absorption of bandages

- I wanted to test for absorbency within bandages, as many bandages are used for different injuries, and depending on the injury, then the absorbency would either be high or low.
- I had a hypothesis, where that if the density of the bandage increased, then the absorbency of the bandage would decrease, as there would be less space for capillary action, or wetting.

- I did a preliminary experiment which helped me to improve my method, and results
- I used four types of bandage:

- Reliform
- Medium
- Stretch
- Cotton Crepe

My results

	Types of bandages											
	Cotton			Reliform			Medium			Stretch		
ass before	0.21	0.24	0.21	0.26	0.25	0.29	0.24	0.27	0.28	0.34	0.32	0.3
ass after osorption	4.73	5.42	4.34	4.15	4.25	4.25	4.54	4.75	4.71	5.83	5.33	5.6
ass change	4.52	5.18	4.13	3.89	4	3.96	4.3	4.48	4.43	5.49	5.01	5.2
	4.61			3.95			4.40			5.26		

Using bandage sizes of 7.5x7.5 cm

Conclusion

- I think that from my results that there is a correlation between the density and the absorbency
- My results show that the more the density increases, the more the absorbency increases, unlike my original hypothesis
- This is understandable, as if there were less atoms in the actual area, then the bandage wouldn’t be able to actually hold the water, meaning that the bandage wouldn’t be absorbent at all
- However, the cotton bandage not match the general trend. This probably indicates that the cotton fibres are more absorbent than the elasticated polymers used in the other bandages
- In conclusion, the more the density increases, the more the absorbency increases

Water Purification Tablets

Ve wanted to test which type of water purification tablet could kill the bacteria in the largest mount of water. In other words, which type could be diluted the most and still function ffectively.

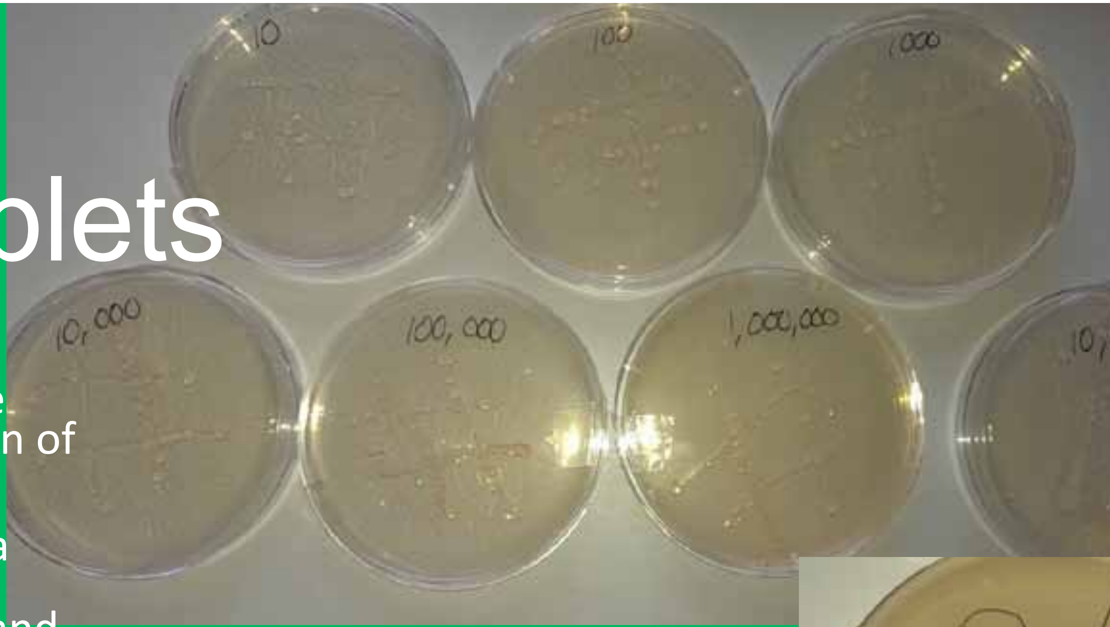
Ve compared three commonly available water purification tablets; silver chloride/troclosene odium, chlorine and chlorine dioxide types.

ur research showed us that

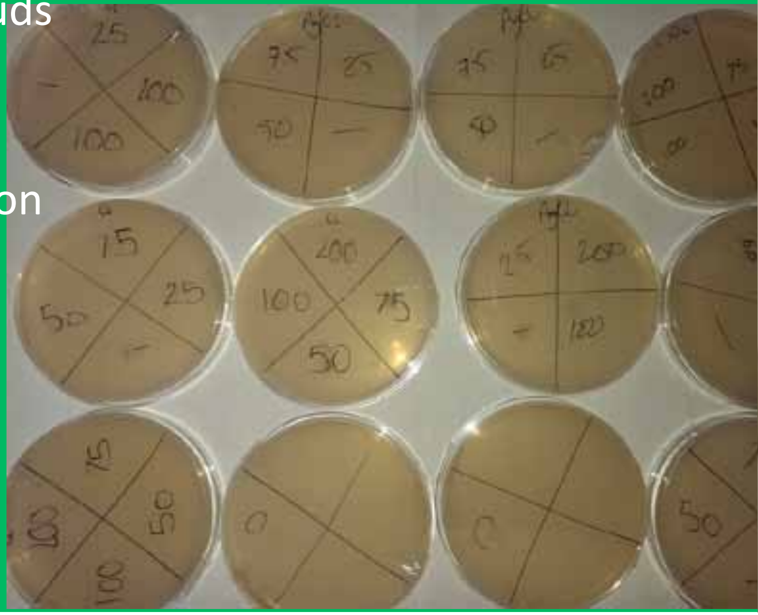
- chlorine dioxide molecules can accept two and a half times as many electrons as chlorine, making each molecule more effective (http://www.globalexw.com/eng/faq.php)
- there was ten times the mass of chlorine in the chlorine tablets,
- The troclosene releases chlorine slowly and in smaller masses. It seems to be designed for long term effectiveness. (http://en.wikipedia.org/wiki/Sodium_dichloroisocyanurate)
- The presence of silver particles will inhibit growth instead of killing bacteria, so this is also long-term meth http://www.nanomedjournal.com/article/S1549-9634(06)00346-7/abstract?cc=y#

verall, we expect the chlorine tablets to be more effective at lower concentrations overall due heir higher mass of the active molecule and immediate effect, but not ten times more effective

Water Purification Tablets



- /e used a yoghurt supplied by the school to obtain bacteria
- /e did a preliminary experiment to find how many times we hould dilute the yoghurt to get an appropriate concentration of acteria
- owever, we found that there was no pattern to the bacteria resent at different concentrations, so we realised that the oculating loops we had used were not properly sterilised, and ad ruined our test
- /e settled on medium level of concentration for the main xperiment
- or the main experiment, we used brand new, sterile cotton buds apply the diluted yoghurt to the agar plates
- /e used small circles of filter paper punched out with a hole uncher soaked in 200%, 100%, 75%, 50%, 25% and 0% of the ecommended concentrations for the tablet and placed these on e agar plates, with several repeats of each concentration for ach type of tablet
- /e incubated the plates at 35°C for 46 hours
- **<u>o bacteria grew on any of the plates, even those with 0% oncentration</u>**



Water Purification Tablets

/e wanted to explain why the problems with our experiment had occurred, so we
id some more research.

- *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, which convert pasteurized milk to yogurt **can** be grown on petri dishes through a similar method we performed http://www.food.gov.uk/sites/default/files/multimedia/pdfs/milkproductguide.pdf
- The Food Standards Agency say that the label on yoghurt must show if the specific yogurt ha been subject to heat treatment. This would kill the bacteria http://www.food.gov.uk/sites/default/files/multimedia/pdfs/milkproductguide.pdf
- The expiry date of the yoghurt had just passed, but if the yoghurt had begun to mould, we would have been able to smell it, and this would have meant there were definitely still bacte
- The cotton buds were standard type and had no disinfectant properties
- The agar plates had been created 6 days earlier and stored in a fridge until we used them. Several protocol forums advised that standard practice is one week, but that if they have bee properly refrigerated, they could last up to several months. http://www.protocol-online.org/biology-forums-2/posts/10067.html

verall, we think it is mostly likely that we were provided with heat-treated yoghu
nd did not realise